Tank Integrity Program

Rough draft observations for further discussion, expansion and development *Suyama 2/5/2021*

Introduction

The Hanford Advisory Board (Board) continues to be extremely concerned about the ability of the Hanford Site's 177 aging waste storage tanks to safely confine the site's estimated 54 million gallons of mixed radioactive and hazardous waste. The Board has repeatedly advised[1] that Department of Energy (DOE) take actions to construct or initiate planning and permitting actions to acquire additional waste storage tank capacity.

The double-shell tanks (DSTs) will remain a key element for the future storage of waste, and the processing and operation of the Direct Feed Low Activity Waste System and the Waste Treatment Plant for another half century.

The Board's Tank Waste Committee (TWC) has been closely following the evolution of the Hanford Site's Tank Integrity Program. Over the years, the TWC has found that the Tank Integrity Program has done an excellent job at implementing new technologies and addressing data obtained in the areas of visual and volumetric, primary tank wall, secondary tank, and under-tank Inspections and performing structural analyses and studies. DOE's efforts have increased the Board's confidence that a better perception of the integrity of the existing tanks now exists. These tanks will be required to safely contain this waste well beyond their design lives. While our knowledge of the physical structure of the tanks themselves is increasing, the corrosive reaction of the materials inside the tank and the tank interior surfaces continues to be limited by our knowledge of the chemical composition and spatial variability of the waste.

The Board remains concerned that the actual physical and chemical composition of the waste remaining in the tanks is indeterminate. Waste layering, a lack of mixing, and extremely limited sampling locations within each tank restrict our knowledge of the actual composition of the waste. Also, the radiological environment within the tanks can subject the material inside the tank to an environment that continues to modify its chemical composition. The question remains; how often, when, and where were these tanks sampled to determine waste composition and changes? Due to a lack of capability for mixing, especially within the stabilized Single Shell Tanks (SSTs), how do we know that the limited samples taken are a valid representation of the preponderance of the waste in the tank?

The Board recommends that DOE:

[1] HAB Consensus Advice #263, Double-Shell Tank Integrity, November 2, 2012
HAB Consensus Advice #271, Leaking Tanks, September 6, 2013
HAB Consensus Advice #275, Path Forward on Tank Waste, March 7, 2014
HAB Consensus Advice #288, FY201 Budget and FY2018 Input Request, April 14, 2016
HAB Consensus Advice #294, Hanford Site Budget, November 14, 2017
HAB Consensus Advice #297, FY2020 Hanford Budget Priorities, June 7, 2018
HAB Consensus Advice #298, DST Failures, September 20, 2018

Commented [RN1]: From Liz Mattson: Two additional advice bullets/recommendations for discussion regarding the concerns that Ecology flagged regarding tank integrity. The language definitely needs work and may just need more discussion of points in the "to discuss" section to be able to better articulate "the ask" here. Placeholder words for now:
- The Board advises that DOE continue working to improve the ability to detect early warning signs that a tank may fail soon, or has failed, and protocol for the appropriate intervention.
- The Board advises that DOE continue working to improve its ability to more quickly respond and pump a tank in an emergency situation in which a tank has failed.

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Commented [BJ*O2]: I believe significant uncertainty still exists regarding the condition of the outer DST shells after decades of attack from the external environment. It seems every year new SSTs are discovered to have water intrusion from outside, despite the fact that waste in the tanks has been drained of liquids. Has sufficient attention has been paid to the effects of soil moisture vapor interactions and the potential for corrosion to have affected the outer DST shells in areas such as the one discovered in AP-102 a couple years ago?

Commented [BJ*O3]: I still don't really see policy advice here yet. The closest thing to it would be the idea that more waste data could facilitate grout, but I don't think it's as simple as that.

Is the point of this advice to say that the integrity panel needs to add new work scope? For what purpose? If we are to suggest that DOE spend resources on its program, it should be to support a key decision or function.

- Is the purpose of the integrity program to increase confidence that the DSTs as currently managed can survive another 50 years+ so that we don't need to construct any more? Is this a premise that we accept, that this is an accomplishable mission by the integrity program? Is the program achieving this objective? If not, what does it need to do?

- Is the purpose of the integrity program to actively prolong the life of the tanks? Is it achieving this objective? If not, what does it need to do? Would the listed activities support this objective? How? (veers dangerously toward the weeds)

- Is the purpose of the program to notify us when the next tank has failed, so that we can know it's time for more tanks? Is the program achieving this objective? Jeff Lyon seemed to think not. If not, what does it need?

... [1]

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- Develop a better understanding of what waste is actually in the estimated 28 million gallons of waste that is still located in the SSTs.

  This data is required to advise or support the effort to reclassify waste based on its constituents verses its origin. If consensus on what the waste is composed of is not reached, we will have to continue the process to stabilize the waste into glass.

- DOE needs to develop a modeling system for SSTs which addresses the following concerns:
  a. History has shown that radiolysis continually reduces the hydroxide levels below tank farm specifications and increases corrosion of tank walls.
  b. DOE has added sodium hydroxide to tanks with mixing capability in the past to increase hydroxide levels back up to within tank farm specifications; however, mixing in SSTs is believed to be non-existent.
  c. SSTs with sludge or salt cake against the tank walls have no mixing capability; therefore, modeling of future corrosion in these areas needs to address hydroxide levels below the specification level.
  d. Technology is needed to determine corrosion rates on SST walls.
  e. DOE needs to determine if distinct layers exist in SSTs and determine accelerated corrosion rates for each layer.

- DOE needs to develop a modeling system for DSTs which addresses the following concerns:
  a. DOE needs to develop technology to determine the thickness of layers in DSTs.
  b. DOE needs to determine the corrosion characteristics for each layer.
  c. DOE needs to determine the effectiveness of mixing which includes an analysis of the range of mixing for each mixing pump within a tank.
  d. DOE needs to identify dead zones where mixing does not change the waste composition against DST walls, and then focus on monitoring the corrosion rates via the tank annulus space to determine if corrosion is higher in those dead zones.

Emergency Pumping Guide? When can we see it?

We should dig deeper into the System Plan 9 analysis, which looks at both: a) building more tanks; and b) more tanks failing. DOE claims losing more tanks won't break the system. I'd like to examine this idea.

Commented [BJ*O4]: The existing WIR process already does this. It is based on sampling of the waste either a) immediately prior to being fed to the WTP or b) in confirmation samples of what's left in the tank after they've retrieved all they feasibly can. Then, based on that information and a performance model, DOE can make the case that the waste is WIR instead of HLW.

To get more data in the tanks at this point has unclear value, in my opinion. What would you really do with more characterization data if you had it today? How much would you need before you'd feel like you knew the whole tank? Is it even possible to collect this information (arguably not because of the minimal spatial access points)?

That said, I do think more data about the presence or absence of organics could inform discussions about how much of the tank waste would make good grout (organics mess up the grout) versus how much needs vitrification to make a stable waste form.

Commented [BJ*O5]: I hope the implication here is not that if we had more data about what was in the tanks, we might grout them in place.

The whole "we will have to continue to make glass" line has connotations like we wish we didn't have to make it. I don't think that's a message we could get HAB consensus on. I still want glass, I just want it to cost less than DOE's new projections are suggesting.

Frankly, I'd like to understand why it's assumed that the DFLAW will cost $500M to run per year (my recollection from the lifecycle report).

Commented [BJ*O6]: I wonder if they could use a hydroxide liquid solution and spray it on the tank walls, letting it soak into the waste along the rim. Could a caustic brine layer be maintained at the bottom of the tank without mixing? Just thinking out loud, not really a HAB policy advice point.

Commented [BJ*O7]: I think the integrity panel has developed calculations for this, but we'd need to check.

Commented [BJ*O8]: What decision would this information support?

Commented [BJ*O9]: What decision would this support?

Page 1: [1] Commented [BJ*O3] BURRIGHT Jeff * ODOE 2/9/21 1:43:00 PM

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- What is the specific trigger (short of a tank actively leaking into soil) that would tell us the next tank is ready for failure and we should start construction? How will we be alerted when this trigger is reached?